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FOREST PEST MANAGEMENT
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BIOLOGICAL EVALUATION OF DWARF MISTLETOE IN SUNSET VALLEY, SANTA LUCIA RD, LOS PADRES NATIONAL FOREST

PSW FOREST AND RANGE EXPERIMENT STATION
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ABSTRACT

Digger pines in Sunset Valley were infected by dwarf mistletoe. The more heavily infected individuals were succumbing to drought and bark beetle attacks. Areas without dwarf mistletoe infection can be identified and protected from infestation by encircling them with buffer zones. Development of a vegetation management plan for the entire area can reduce future mortality and provide for healthier vegetation.

INTRODUCTION/OBSERVATIONS

At the request of the Los Padres NF, we examined dying Digger pines on the Santa Lucia Ranger District. We were accompanied by Dennis Cooper from the District on August 20, 1985.

Dead and dying Digger pine have been observed along Road 8N09 from Cachuma Saddle through Sunset Valley to the trailhead into the San Rafael Wilderness at Nira campground. Digger pine occur as individuals and groups of various sizes, interspersed with coast live oak, black oak, western juniper, and various shrub species. Stocking levels vary considerably, but overall stocking is sparse to poor. The road is heavily used by recreationists going to several campgrounds and to the wilderness.

The most pervasive and damaging pest of Digger pine along the road is dwarf mistletoe, Arceuthobium occidentale. Infection levels range from none to very heavy along different portions of the road. The dead and declining trees are those with heavy infections of the parasite. The mistletoe appears to be spreading outward from infested areas when susceptible trees are within the limits of spread of the mistletoe seed. Noninfested areas are becoming distinct islands of trees, oftentimes being protected from infection by the lack of hosts to carry the mistletoe from surrounding infected trees.

BIOLOGY OF DWARF MISTLETOE

Dwarf mistletoes (Arceuthobium spp.) are parasitic, flowering plants that can only survive on living conifers in the Pinaceae. They obtain most of their nutrients and all of their water and minerals from their hosts. Digger pine dwarf mistletoe (A. occidentale) infects Digger pine, Coulter pine, and Monterey pine.

Dwarf mistletoes spread by means of seed. In the fall the fruit ripen and fall from the aerial shoots. The seeds are forcibly discharged. The seed is covered with a sticky substance and adheres to whatever it contacts. When a seed lands in a host tree crown, it usually sticks to a needle or twig, where it remains throughout the winter. The following spring the seed germinates and penetrates the twig at the base of the needle. For the next 2-4 years, the parasite grows within the host tissues, developing a root-like system within the inner bark and outer sapwood, and causing the twig or branch to swell. Aerial shoots then develop and bear seed in another 2-4 years.

Dispersal of dwarf mistletoe seeds is limited to the distance the seeds travel after being discharged. From overstory to understory, this is usually 20 to 60 feet, but wind may carry them as far as 100 feet from the source. A rule of thumb is that the seeds can travel a horizontal distance equal to the height of the highest plant in an infected tree. There is some evidence that long distance spread of dwarf mistletoe is occassionaly vectored by birds and animals.

Vertical spread within tree crowns of most dwarf mistletoes is limited to less than one foot per year because of foliage density. Because of the thin crowns of Digger pine, however, the vertical rate of spread has been measured as being greater than 2 feet per year. This rate of spread equalled or exceeded the rate of height growth of infected trees.

Dwarf mistletoes are easy to identify because they are generally exposed to view within a tree's crown. Signs of infection include the yellow-green to orange mistletoe plants, basal cups on a branch or stem where the plants were attached, and detached plants on the ground beneath an infected tree. Symptoms include spindle-shaped branch swellings, witches' brooms in the lower crown, and bole swellings.

MANAGEMENT ALTERNATIVES

1. No Action. The recent increase in mortality of Digger pine is a result of heavy dwarf mistletoe infections and inadequate precipitation. With a return to normal precipitation, mortality levels will decline, but heavily infected trees will continue to die from bark beetle attacks. Spread of dwarf mistletoe into noninfested areas will continue when host trees are available to intercept seed. The eventual result will be a decline in the number, health, and vigor of Digger pine along the corridor. Oaks and juniper will probably not replace lost pines, but instead, brush will fill in the open areas.

2. Protect Noninfested Areas. Areas without infected trees can be protected from invasion by dwarf mistletoe. This will require identifying and delineating healthy, noninfested areas. Actual protection will require the establishment of buffer zones that are free of hosts around these noninfested areas. Buffer zones do not have to follow the actual boundary between infested and noninfested areas, but can be adjusted to utilize artificial barriers and existing host free situations and to maintain tree cover in visually sensitive areas. If these adjustments result in the inclusion of infected trees in noninfested areas, then special treatments must be performed on these trees, such as pruning, to remove infections. Specific pruning guidelines are below.

Buffer zones should not be less than 50 feet wide, even on level ground. If infected Digger pines in surrounding areas are more than 50 feet tall, then the zone should be at least as wide as the height of the tallest host tree. On a slope where the infected trees are above the buffer zone, one foot should be added to the zone width for each degree of slope.

a) Buffer zone. All host trees within the buffer zone need to be killed, even if they are not infected, to prevent reinvasion by dwarf mistletoe from the surrounding areas. This can be accomplished by felling or killing the tree and leaving it standing.

b) Pruning. If infected trees are left within the area protected by buffer zones, all infections must be removed. Trees with 2/3 or more of their crown infected will probably not survive pruning and should be killed. Trees with less than 2/3 of their crown infected may be pruned free of infections if certain guidelines are followed.

   1) Prune all branches, including those without dwarf mistletoe shoots, up to and including two whorls above the highest visible infection.

   2) Prune all branches at the bole.

   3) If branch swellings from dwarf mistletoe are within 2 inches of the bole, then the parasite has probably already entered the bole and the tree should be killed.

   4) Do not remove more than 1/2 of the live crown. Also, do not prune to less than a 30% live crown ratio. Such measures could result in tree mortality even without dwarf mistletoe. It is more efficient to remove these trees during the control operation.

c) Monitoring and Retreatment. Even with the most careful survey and control operation,dwarf mistletoe can be missed because of latent infections. This necessitates additional treatments in future years to ensure that noninfested areas are successfully protected. Every 2 to 3 years these areas need to be carefully examined for any missed infections or reinvasion. Three such examinations should be performed. If infections are discovered, then they must be addressed quickly to limit further spread and eradicate the parasite. If infections appear to be from reinvasion, then the source needs to be identified and appropriate actions taken.

3. Vegetation Management. Although dwarf mistletoe is the principal threat to Digger pine at this time, the long-term health of the vegetation along this corridor will be determined by the type of management that is implemented. Development of a vegetation management plan that includes consideration of species diversity, stocking levels, regeneration, competition, and pests could result in retaining existing mature trees and assuring healthy vegetation into the future. Such a plan needs to be formulated following examination of soil and site characteristics, existing vegetation patterns, and management objectives.

Forest Pest Management personnel are available, upon request, to assist in on-the-ground examinations of specific sites, especially with regard to formulating a a dwarf mistletoe suppression project in Sunset Valley. This includes identifying particular treatment methods for individual situations.